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## Crude Oil Spill Response in the Great Lakes Region: Before and After the 2010 Kalamazoo River Enbridge Oil Spill

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Crude Oil Incident Response in the Great Lakes: Before and After the 2010 Kalamazoo River oil  
Spill Reflection  
Marshall Kim

Putting together this honors thesis was one of the most powerful, exciting and rewarding experiences of my collegiate career at Western Michigan University. I believe that completing this thesis has helped me to build a stronger understanding of concepts relating to oil pipeline infrastructure in the United States. In addition this project has given me skills in putting together a research project along with the utilization of ArcGIS Online. The purpose of this project was to investigate how crude oil incident response in the Great Lakes region changed from before and after the 2010 Kalamazoo River Enbridge oil spill.

I first became interested in this subject when I learned about the 2010 Kalamazoo River spill. I had never heard of this spill until I came to Western. It was surprising to me that the spill happened in 2010 while I was going into 6th grade and I had no idea. At the same time I found out about the Kalamazoo River oil spill, I was hearing news from the Standing Rock protests about the Dakota Access Pipeline. These two events sparked my interest around pipeline infrastructure and oil spills in the United States.

I also began learning about the controversy around Enbridge's Line 5 pipeline under the straits of Mackinac. I became captivated by these pipelines that pump oil underneath our feet that so few of us think about on a daily basis. In doing this project I was looking to spread awareness around these issues along with exploring my interests in the issue. I wanted to raise awareness about the immensity of this network in the United States, and how often spills occur.

In addition to highlighting the vastness of this network in the United States, I specifically wanted to highlight the immense number of pipelines that exist within the Great Lakes region alone. I feel that when people think of the Great Lakes, pipeline spills are not among the first issues that people imagine affecting the region. For this reason this project was meant to give viewers a more in depth idea of how crude oil spills unfold in the Great Lakes region.

To achieve all of the objectives I decided that the most efficient medium would be to create an ArcGIS story map. The primary reason I decided to do this was because of the way that ArcGIS story maps are able to display interactive and user friendly maps. Due to the fact that I created a series of maps displaying where spills occurred between two different cohorts (2002-2009 & 2010-2018), I wanted users to be able to interact with the maps and information that was being presented.

I feel that when looking to understand pipeline infrastructure in the U.S., it is important to be able to visualize where pipelines are and what the network looks like. For this reason I felt a story map would help people visualize and comprehend the immensity of pipelines in the U.S. When exploring the different spills that have happened in the Great Lakes region I also felt it was important to be able to have visuals of what the events actually looked like. For this reason I felt that the story map format provided an excellent medium to display these spills.

Through working on this project I learned a great deal about the subject I was interested in. While I was collecting data about the spills that took place in the Great Lakes region from 2002-2018, I learned about the regulatory agencies that are involved with pipelines. Prior to beginning this research I did not know what agencies were involved with the regulation of pipelines; carrying out this thesis helped me to gain a better understanding of which agencies are involved. I learned about how the National Transportation Safety Board is involved with pipelines in a regulatory manner. I also became aware of how the U.S. Department of Transportation, specifically through the Pipeline and Hazardous Materials Safety Administration (PHMSA), is in charge of setting regulations for pipelines along with disseminating information about pipeline miles and incident data. It was also particularly interesting seeing how the PHMSA and the EPA are involved with organizing pipeline spills response. I gained an understanding of the capacity in which the EPA takes charge of spill events along with how the PHMSA is in charge of regulating pipeline companies involved in spills.

While I was downloading data of spills in the Great lakes region from 2002-2018, I also learned that there are a lot of spills that occur in the region. Before initiating this project, I had no idea how often pipeline spills occurred in the Great Lakes region. Downloading this data and visualizing where these spills occurred uncovered an unexpected amount of spills that occurred within the region. I was able to see where pipeline spills were happening and it helped me to understand how large of an issue this is. It felt like important work that I was doing because while I was doing preliminary research into the subject, I was able to find few, if any, maps displaying where crude oil spills have occurred specifically in the United States. My thesis project serves to show what spill response in the Great Lakes region looks like and where spills have occurred.

I also learned a great deal about oil incident response in the Great Lakes region. While reading about all of the spills that I investigated in detail, I built an understanding of what oil spill response generally looks like and what goes into response actions. Many of these strategies include the use of oil containment booms, vacuum trucks, the excavation of soil, air monitoring and sometimes even controlled burns. Through researching spill response in the Great Lakes region, I also became familiar with different agencies that are often involved in oil spills such as the U.S. Fish and Wildlife Services and the Coast Guard.

By completing this honors thesis, I found that I am very passionate about this work relating to crude oil pipelines. Although this project required long days of work collecting and organizing data, researching oil spills and putting together a website, it was always exciting for me to do this work. In the future I would love to continue this project and carry out a wider study. I feel I have a much stronger understanding of pipelines in the United States and especially the Great Lakes Region. This is exciting for me and it feels incredibly rewarding to see the end product of almost a year's worth of research and work. It is also exciting for me knowing that I would be willing to continue this work and build on this research that I conducted.

Completing this Lee Honors College thesis has been an eye opening and enlightening experience. I am thankful that I began this endeavor and stuck with the research. It is also exciting because I developed powerful relationships with multiple faculty members in the Geography department at WMU through doing this project. I plan to build on this research and rely on what I have learned through this experience as well.